

## PHOTO CAPTIONS AND CREDITS FOR ESD RESEARCH SUMMARIES 2006–2007

### FRONT COVER

- (Top) Climate model simulation of sunlight reflected by aerosols for 2001 (courtesy of David Fillmore and Bill Collins)  
(Lower Left) U-tube apparatus, Frio Brine pilot project, TX  
(Lower Right) Tunnel boring machine for Yucca Mountain Project, Yucca Mountain, NV

### BACK COVER

- (Top) Three-dimensional resistivity image derived from Coso (CA) Geothermal Field from magnetotelluric data sets (courtesy of Greg Newman)  
(Lower Left) The Berkeley Unexploded Ordnance Detector (BUD) and its developers—winner of a 2007 R&D 100 Award  
(Lower Right) Simulation of Yucca Mountain experiment using 3-D unsaturated flow code (courtesy of Stefan Finsterle)

### DIVISION DIRECTOR'S PERSPECTIVE

- (page 1) Earth Sciences Division, Building 90, LBNL (aerial view)  
(page 3) Earth Sciences Division Council  
(page 4) Geosciences Measurement Facility (GMF).

### RESOURCE DEPARTMENTS

- (page 7) John Peterson collecting surface electromagnetic data at the uranium-contaminated Rifle, CO, field study site, to delineate subsurface heterogeneity

#### *Hydrogeology*

- (page 9) Barry Freifeld and Tom Daley at the Otway Basin Pilot Project, Victoria, Australia

#### *Geophysics*

- (page 11) Seismic vibroseis source truck at borehole geophysical project site in West Texas. Field personnel (left to right): Dale Cox (Berkeley Lab), Ernie Majer (Berkeley Lab), Cecil Hoffpauir (Univ. of Texas), Tom Daley (Berkeley Lab), John Queen (Hi-Q Geophysics). Not pictured: Alex Morales (LBNL)

#### *Geochemistry*

- (page 13) Tom Owen in the Center for Isotope Geochemistry

#### *Ecology*

- (page 15) Terry Hazen (left) and Gary Andersen, ESD microbiologists, with the Berkeley Lab PhyloChip, a microarray that can analyze a sample for the unique DNA signatures of all known bacterial species. The PhyloChip won a 2008 R&D 100 Award.

#### *Climate Sciences*

- (page 17) The Carbon Explorer transmitting data from the Southern Ocean. The Carbon Explorer, a “smart” telemetry-enhanced ocean float with advanced optical sensors for characterizing carbon in the ocean, won a 2006 R&D 100 Award.

## RESEARCH PROGRAMS

---

(page 19) Oil drilling program to deploy an x-ray diffraction apparatus

### *Energy Resources*

(page 21) Emplacement of geophones in microwells for monitoring enhanced oil recovery with CO<sub>2</sub>

### *Fundamental and Exploratory Research*

(page 37) Computer simulation of isotopic fractionation during aqueous diffusion (courtesy of Ian Bourg)  
Photography by Barry Freifeld

### *Environmental Remediation and Water Resources*

(page 53) Installation of shallow electrode holes by ESD's Kenneth H. Williams and Phillip Rizzo at DOE's Rifle Integrated Field Challenge (IFC) site near Rifle, Colorado. Nonpolarizing electrodes are embedded in each hole and used for induced polarization monitoring of stimulated subsurface bioremediation activities under investigation at the Rifle IFC site.

### *Climate and Carbon Sciences*

(page 87) Pat Dowell (ARM technician) collecting a pair of flask for trace gas analysis (including: CO<sub>2</sub>, CO, CH<sub>4</sub>, N<sub>2</sub>O, <sup>13</sup>CO<sub>2</sub>, CO<sup>18</sup>O, carbonyl sulfide, and many trace hydrocarbon species) at the Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF) in the Southern Great Plains. Note the DOE aircraft in the upper left corner, flying vertical profile over the site.

### *Geologic Carbon Sequestration*

(page 103) As part of an Australia-U.S. collaboration under the GeoSeq project, ESD researchers designed, built, and deployed the downhole monitoring and fluid sampling assembly shown here being installed by crane into the Otway Basin Pilot Project observation well in Victoria, Australia.

### *Nuclear Waste*

(page 125) Gudmundur ("Bo") Bodvarsson (1952–2006):  
Leader, mentor, and guiding force for ESD and its Nuclear Waste Program  
"Bo lived his life 48 hours a day"  
—Odette Lockwood-Stewart, Pastor of the Epworth Methodist Church, Berkeley, California

## PRODUCTION CREDITS

---

Design and Production: Walter Denn, ESD

Editor: Dan Hawkes, ESD

Production Management: Kryshna Avina, Maryann Villavert, ESD

Publication List: Dan Hawkes, ESD

Photography: Roy Kaltschmidt (Creative Services Office, LBNL), except where noted